Remarks/Arguments:

Claims 8, 17-24, 34-37, and 40 are pending in the application and were examined. No amendments to the claims are made with this response.

These remarks are directed to the Final Office Action of March 15, 2011. Affidavits may be admitted after a final rejection upon a showing of "good and sufficient reasons why the affidavit or other evidence is necessary and was not earlier presented." 37 C.F.R. § 1.116(e). Applicants respectfully submit that the following remarks are necessary to respond to issues that the Examiner raised for the first time in the Final Office Action, particularly with respect to newly cited references, namely, EP 427094 to Blouin and WO 01/56384 to Nonomura. Paragraph numbers in these remarks refer to the published application U.S. Pub. No. 2007/0027032.

Response to Claim Rejections Under 35 U.S.C. § 103

Claims 8, 17-24, 34-37, and 40 stand rejected under Section 103(a) as unpatentable over WO 00/04778 to Smith ("Smith '778") in view of EP 427094 to Blouin ("Blouin") or WO 01/56384 to Nonomura ("Nonomura"). Claims 8, 17-24, 34-37, and 40 also stand rejected under Section 103(a) as unpatentable over WO 01/26465 to Smith ("Smith '465") in view of Blouin or Nonomura. Applicants respectfully traverse these rejections and submit that claims 8, 17-24, 34-37, and 40 are patentable over Smith '778 in view of Blouin or Nonomura, and are also patentable over Smith '465 in view of Blouin or Nonomura, for at least the reasons set forth below.

In applying Section 103, the Supreme Court has directed the USPTO to make underlying factual inquiries as stated in *Graham v. John Deere Co.*, 383 U.S. 1, 17-18 (1966), and as affirmed in *KSR International Co. v. Teleflex, Inc.*, 550 U.S. 398 (2007), as follows:

(1) Determining the scope and content of the prior art;
(2) Ascertaining the differences between the claims at issue and the prior art;
(3) Resolving the level of ordinary skill in the pertinent art; and
(4) Evaluating evidence of secondary considerations.

To establish a *prima facie* case of obviousness by combining prior art elements, it is also necessary to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the prior art elements in the manner claimed. M.P.E.P. §2143(A).

The claimed invention provides methods for increasing fruit number, fruit weight, biomass, or yield in plants by applying *multiple doses* of lipochitooligosaccharides (LCOs) at a concentration of from about 1 ng to about 1000 ng per plant. Independent claim 8 recites:

> A method for increasing fruit number or fruit weight in a nonleguminous plant comprising the steps of applying to the plant a first dose of a lipochitooligosaccharide (LCO) at a concentration of from about 1 ng to about 1000 ng per plant; and applying to the plant a second dose of an LCO at a concentration of from about 1 ng to about 1000 ng per plant.

Independent claims 21 and 40, while not identical to claim 8, recite similar features, including the application of multiple doses of an LCO. Applicants submit that, in view of the differences between the claims at issue and the scope and content of the prior art, one of ordinary skill in the art would not have had a reason to combine the cited references in the manner claimed, and the rejection therefore fails to meet the obviousness standard set forth in M.P.E.P. §2143(A).

Smith '778 is directed to methods for promoting seed germination, seedling emergence, or growth in plants by exposing the plants to LCOs (Smith '778, Abstract). Smith '465 is directed to methods for increasing photosynthesis, growth, or yield in crop plants by exposing the plants to LCOs (Smith '465, Abstract). The Office Action acknowledges that both Smith '778 and Smith '465 fail to disclose multiple applications of LCOs, as required by the present claims, but alleges that Blouin or Nonomura make up for this deficiency.

Blouin is directed to a delivery system for plant fertilizers that is effective for enhancing plant nutrition (Blouin, page 2, lines 19-22). The fertilizer material includes multiple nutrient components in a composition, such as phosphoric acid, calcium, sulfur, zinc, copper, manganese, and/or potassium (Blouin, page 2, lines 29-30, and page 3, lines 6-8). Applications of the fertilizer material are preferably made in amounts of 5 to 20 pounds per acre, and may be made in multiple applications. In Example III, the fertilizer is applied to orchard trees in an amount of 100 gallons per acre by a tank trunk equipped with a sprayer (Blouin, page 4, lines 41-43, page 5, lines 30-31, page 6, lines 1-10).

Nonomura is directed to methods and formulations for enhancing plant growth by applying conjugated indoles, or derivatives thereof, to plants (Nonomura, Abstract). The indoles act as substrates for biosynthesis, particularly as substrates for cellulose synthesis (page 5, lines 5-6). Formulations in Nonomura are typically applied in an amount of 3 to 100

gallons per acre, and may be applied in multiple applications. The formulations may be applied, for example, by helicopter or airplane crop dusters (Nonomura, page 18, lines 19-31).

There are vast differences between the claims at issue and the scope and content of the prior art. In particular, Blouin and Nonomura differ from the present claims in the types of substances being applied to plants and the mechanisms by which the substances enhance plant growth. Plant nutrients, such as those described in Blouin, consist of chemical elements that are necessary for plant growth. Nutrients become incorporated into plant tissue or are used as substrates for the synthesis of plant tissue. The indoles in Nonomura are used as substrates for the synthesis of cellulose, a major component of plant tissue. Thus, the materials described in Blouin and Nonomura contribute directly to the actual synthesis and growth of plant tissue by incorporating the applied materials. One of ordinary skill in the art would therefore expect multiple applications of such materials to lead to increased plant growth. On the contrary, the claimed lipo-chitooligosaccharides (LCOs), are *signal molecules* composed of acetylglucosamine residues which are released by bacteria and trigger nodule development in host plants. Signal molecules do not serve as substrates for the generation of plant tissue, unlike the materials described in Blouin and Nonomura, but act by binding to specific receptor sites on the plant and activating natural plant genes. The limited teachings in Blouin and Nonomura would not lead a skilled artisan to expect that multiples doses of a *signal molecule*, such as an LCO, would lead to increased fruit number, fruit weight, biomass, or yield in plants, as signal molecules are not directly involved in the actual synthesis of plant tissue.

Moreover, the materials disclosed in Blouin and Nonomura are applied in significantly larger quantities than those of the instant claims. The nutrients of Blouin can be applied in amounts of 5 to 20 pounds per acre (Blouin, page 4, lines 41-42), and the substrates of Nonomura can be applied in amounts of 3 to 100 gallons per acre, or 1 to 5 gallons per acre for aerial applications (Nonomura, page 18, lines 19-28). On the contrary, the LCO of the present claims is applied in an amount of about 1 ng to about 1,000 ng per plant. Thus, even a high volume of 30,000 plants per acre would require amounts of only about .03 mg to about 30 mg LCO per acre according to the present claims, which are significantly lower than the amounts of material applied in Blouin and Nonomura.

One of ordinary skill in the art would have recognized that Blouin and Nonomura disclose materials that play an entirely different role in plant growth compared to signal molecules, and would have no reason to incorporate those teachings into either Smith '778 or Smith '465,

which relate to the application of LCOs to plants. The claimed invention resulted, in part, from an unexpected discovery that applying multiple doses of an LCO leads to increases in fruit number, fruit weight, biomass, and yield in plants, compared to single doses. In view of the differences between the claims at issue and the scope and content of Smith '778, Smith '465, Blouin, and Nonomura, one of ordinary skill in the art at the time of the present invention would have had no reason to apply multiple doses of an LCO to a plant in order to increase fruit number, fruit weight, biomass, or yield, as required by the present claims. Applicants therefore respectfully submit that the Office has not met its burden of establishing a *prima facie* case of obviousness, as the rejections under 35 U.S.C. § 103 fail to meet the obviousness standard set forth in M.P.E.P. §2143(A). Claims 17-20, 34, and 36 depend from claim 8, and claims 22-24, 35, and 37 depend from claim 21, and are therefore also patentable over Smith '778 in view of Blouin or Nonomura, and Smith '465 in view of Blouin or Nonomura, but may be separately patentable for additional reasons as well.

Applicants also reiterate that data in the present application show that the methods recited in the present claims have unexpected properties not present in the cited art. M.P.E.P. § 2145. Applicants have discovered that applying multiple doses of an LCO results in unexpected increases in fruit number or fruit weight in non-legumes, and unexpected increases in biomass or yield in legumes. For example, as described in paragraph [0052], twenty tomato plants were treated with "50 ng and 75 ng LCO per plant, applied once (2 weeks after transplanting) and twice (4 weeks after transplanting)." As a result, "[o]n fruit number the 50 ng LCO treatment applied twice showed significantly higher numbers over control for the first 4 weeks" (see paragraph [0053]). As shown in Table 2, when two doses of LCO were applied within about two weeks of each other (i.e., "First Application: Feb. 21, Second Application: Mar 7, 2003"), there were significant increases in fruit number per plant compared to plants that were treated with only a single dose of LCO. The most significant increase in fruit number occurred when 50 ng LCO were applied twice, compared to 50 ng LCO applied once. For example, two weeks after the application of a second dose of 50 ng LCO (on March 21st), there was an average fruit number of 1.8 fruits per plant for plants treated twice with 50 ng LCO, compared to 0.25 fruit per plant for plants treated only once with 50 ng LCO. In fact, four weeks after the application of the second dose of 50 ng LCO (on April 4th), the plants that had been treated only once with LCO had an average fruit number of only 1.3, which was still lower than the average fruit number for plants treated twice with 50 ng LCO after only two weeks.

Applicants have demonstrated a surprising increase in the resulting fruit number or fruit weight when non-leguminous plants are treated with two separate doses of LCO instead of a single dose, and have also demonstrated a surprising increase in the resulting biomass or yield when leguminous plants are treated with two separate doses of LCO instead of a single dose (see paragraph [0122] and Table 8).

Conclusion

Applicants respectfully request reconsideration of the rejections in view of the remarks submitted herewith. Applicants submit that the pending claims are in condition for allowance, which action is respectfully requested.

Respectfully submitted,

Jonathan H. Spadt, Reg. No. 45,122
Lisa A. Mead, Reg. No. 64,253
Attorneys for Applicants

JHS/LM/pbm

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P.O. Box 980
Valley Forge, PA 19482
(610) 407-0700

The Director is hereby authorized to charge or credit Deposit Account No. **18-0350** for any additional fees, or any underpayment or credit for overpayment in connection herewith.

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